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What Nutrients Do Pines Need?

Farmers fertilize their corn crops. Stockmen provide supplemental food for their range cattle. Having seen the benefits from these practices, forest managers are asking if they should be fertilizing their pine trees.

Adding fertilizer to bring soil nutrients into balance probably will improve growth and vigor of pine trees if done right. That is the opinion forest scientist Eugene Shoulders expresses as he talks about his work to develop land management practices to maximize growth and quality of southern pines on the Coastal Plain soils of the Gulf region.

In the past, physical properties such as texture, depth, and available moisture were the soil characteristics most often used to estimate site productivity, said Shoulders, a Southern Forest Experiment Station researcher at the USDA Forest Service laboratory at Pineville, Louisiana. But land managers now want to know if they can greatly improve tree growth by adopting agronomic practices, such as fertilization.

Forest fertilization is a proven and acceptable management practice in limited areas of the South. But for most of the area, general use will probably have to wait until exact amounts and specific kinds can be reliably prescribed for individual soils, Shoulders said. He and his fellow researchers are on the way to providing at least some of the prescriptions.

In certain areas of the South, a single nutrient, usually phosphorus, is very deficient in the soil. There have been pronounced responses where sup-

Continued on p. 6, col. 3

BUYING WOOD BY WEIGHT

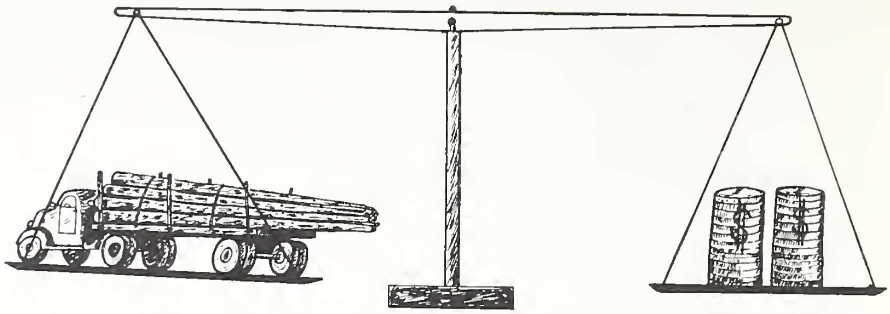
Centuries ago when wood was the primary fuel for heating, its price in some parts of Europe was determined by weight. Other units such as the cord and the board foot arose as manufacturers became the major consumers. Manufacturers preferred to base the price of logs on the quantity of products that could be made. Now, thanks to research by USDA Forest Serv-

Researcher Bill McKee measures the tallest tree on a fertilized plot, 2 years old from seed.

ice economists, an increasing number of wood-processing firms in the United States are buying wood by weight. Weighing is much cheaper, easier, and more objective than traditional scaling methods. And with modern computers the processor can estimate how much of his products can be made from a given weight of wood.

Pulp and paper manufacturers were the first to become interested in weight scaling. They were selling pulp products by weight, but were buying roundwood at their mills by the cord—a stack of wood that fills a space of 128 cubic feet. They realized that weight was a fairer and more practical measure of pulpwood value than was cords. A cord of small or crooked pieces contains considerably less solid wood than a cord of large, straight pieces. When weight scaling was introduced at pulpmills, loggers had to be convinced that the new pricing method was fair. Probably because weighing can be done so objectively, loggers were quickly won over.

Both sawmillers and loggers were dissatisfied with the traditional method of scaling logs that would be converted into boards, and for good reasons. Several different rules for converting log size into board-foot content were being used, and the estimates by different rules differed. Furthermore, to scale the log, its length and diameter had to be measured and deductions made for defects such as crook and rot. Disagreements frequently arose over the size of deductions for defect, and since logs are seldom round, scalers sometimes disagreed about diameters. Scaling required skill, judgment, and a lot of time. Meanwhile the truck and its driver were idle.



Sam Guttenberg, an economist at the Southern Forest Experiment Station, directed a team which developed equations for estimating board-foot content of loads of logs if the weight and number of logs were known. Sawmillers and loggers doubted that their problems could be solved so easily. The researchers had to demonstrate that the system was fair as well as efficient. This they were able to do with a number of firms, and today their equations are being used in sawmills throughout the South. Where the system is used, the buyer and seller can readily agree on the proper price for a load of logs.

In the South's rapidly expanding forest industries, however, the newest plants buy wood for a variety of products. The largest logs are made into veneer for plywood, smaller logs are converted into boards, and the smallest pieces are converted into pulp. Often, the logs are delivered in tree lengths and divided into the lengths most advantageous for processing at the mill yard. Some way was needed to estimate volumes and values of these tree-length pieces. Manufacturers again turned to the Forest Service for a solution.

They were not disappointed. Researchers soon provided a set of equations and administrative tables for multiple-product scaling by weight. Clyde Fasick and Gary Tyre, economists at the Southeastern Forest Experiment Station, led in developing computer programs to estimate volumes of each product from weight for individual firms. It is also possible to grade timber indirectly by weight-scaling as well as estimate its volume.

The programs have proved highly effective, and a program manual for weight scaling is available from the Southeastern Forest Experiment Station, Box 2570, Asheville, North Carolina 28802. Reprints of Guttenberg's articles are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113.

Most of the firms interested in multiple-product weight scaling have access to the necessary computing facilities. Advice on use of the programs is being provided by the Southeastern Area State and Private Forestry, 1720 Peachtree Road, N. W., Atlanta, Georgia 30309.

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Pines Monitor Air Pollution

Eastern white pines are tattletales where air pollution is concerned. Their needles change color or even die when exposed to airborne pollutants such as fluorides, oxidants, and sulfur dioxide. Not all white pines respond in the same way to the same pollutant, however. Some trees are injured by only one of these three pollutants but are resistant to the other two. Such trees may soon be enlisted as detectives to spot areas of air pollution and even to identify which pollutant is on the loose.

Dr. Charles R. Berry of the Southeastern Forest Experiment Station recently conducted a study in which the same seedlings of white pine were exposed for 1-year periods to sulfur dioxide from a power plant in east Tennessee, fluorides from a fertilizer plant in north Alabama, and oxidants (such as ozone) from a metropolitan area in south Maryland. These multiple exposures revealed that some of the seedlings were susceptible only to fluorides, some only to oxidants, and some only to sulfur dioxide. Furthermore, some of the susceptible seedlings were injured only in winter, some only in summer, and others during both seasons. Each of these groups is being propagated to serve as bioindicators of a particular pollutant. Trees susceptible during only one season can even be used to determine when the pollutant is present. Other seedlings in the study proved to be resistant to all three gases. These seedlings will be used to establish resistant lines for seed orchards.

Because they are evergreens, eastern white pines can serve as semipermanent, year-round monitors of air pollution from industrial and other sources. The only maintenance they require is a small application of fertilizer and light pruning once a year. Unlike man-made instruments, they need no electrical power. Such bioindicators will be particularly useful to those who wish to monitor local trends but cannot afford a more complex system.

Details of Dr. Berry's study are reported in an article entitled "The Differential Sensitivity of Eastern White Pine to Three Types of Air Pollution" in a recent issue of the *Canadian Journal of Forest Research*. Reprints are available on request from the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, North Carolina 28802.

Grafts from white pines resistant (left) and susceptible (center) to SO_2 after 7 months' exposure near a coal-burning power plant. Another graft from the susceptible line (right) was maintained in an unpolluted area during the exposure period.

More Timber, Less Forest In Carolina Coastal Plain

Timber volume in the Southern Coastal Plain of North Carolina increased by 573 million cubic feet, or 12 percent since 1962. Area of commercial forest land decreased by almost 5 percent over the same period. For every acre of land reverting to forest, 4 acres were diverted to nonforest uses. These are some of the findings of a forest survey recently completed by the Southeastern Forest Experiment Station with the help of the North Carolina Forest Service and forest industry.

Commercial forest now occupies 5.4 million acres, or 64 percent of the total land area. Since 1962, 4 out of every 10 acres have either been harvested, regenerated, treated, or disturbed. Timber was harvested or thinned on 1.7 million acres, and over 430,000 acres were artificially reforested. The USDA Forest Service report points out that although average stand density has increased, one-third of the stands are still poorly stocked.

In 1972, timber growth exceeded removals by 54 million cubic feet, with hardwood accounting for 63 percent of the growth over removals. A disproportionate share of the removals was pine. For example, pine made up 53 percent of the inventory, accounted for 63 percent of the growth, but provided 71 percent of the removals.

Copies of the report, "Forest Statistics for the Southern Coastal Plain of North Carolina, 1973," by Noel D. Cost, are available on request from the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, North Carolina 28802.

Why Not Take All Of Me?

Did you know that about one-fifth of every pine tree harvested remains underground and not visible to the naked eye?

Why then couldn't land managers utilize this wood, thus getting the most out of any tree cut and keeping the number harvested to a minimum?

Good idea, says Forest Service researcher Dr. Peter Koch, who has designed a machine to pluck the taproot from the ground—like a big carrot—while it is still attached to the tree trunk.

A look at a slash pine root hanging in Dr. Koch's laboratory quickly reveals the amount of wood involved. A 22-year-old slash pine growing in sandy loam soil normally has a taproot about 5 feet long, with a diameter a few inches below the ground one and a half to two times the stem diameter at breast height. Chemical properties don't differ greatly from the stemwood. The taproot, therefore, should be a suitable source of pulpwood, according to Dr. Koch.

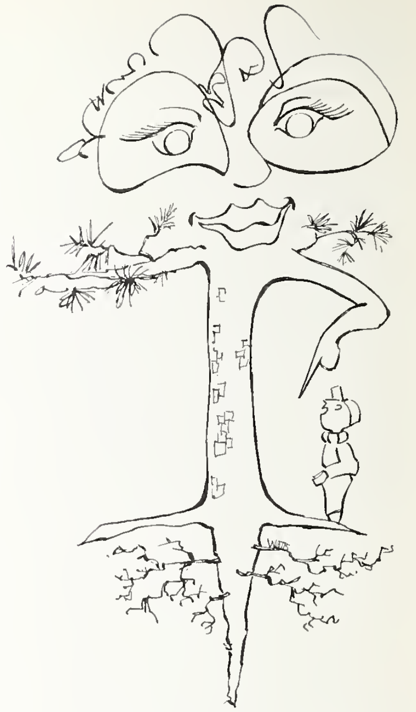
Koch's machine shears off the lateral roots close to the taproot, leaving them in the ground. The laterals comprise less than one-third the weight of the root system and would greatly increase the difficulty of extraction, transportation, and chipping. The roots are severed with a tubular shear sharpened on its lower edge and hinged like a big clam shell to encircle the tree.

To try the idea, Rome Industries of Cedartown, Georgia, made a prototype of the machine, which was tested during September 1973 with 15-year-old plantation-grown pines on dry, hard Georgia clay.

The concept worked as planned. The shear was driven into the ground to sever the lateral roots. Then the tree trunk and taproot were lifted through the shear. The hole left by the root was neat and small. It quickly caved in as the harvesting machine moved about the area.

A second prototype is being designed. If the research proves successful, it will permit owners of plantations in rock-free soil to harvest 20 percent more wood weight per acre than they normally did.

More information is available in an article which appeared in SOUTHERN LUMBERMAN magazine January 1, 1974, and in the May 1974 issue of the JOURNAL OF FORESTRY. Reprints of both articles are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113.



A tubular shear sharpened on its lower edge severs lateral roots.

The taproot, still attached to the trunk, is plucked from the ground like a big carrot. Only a neat, small hole is left by the root.

KIT FOR SURVIVAL

Independent sawmill operators have had to increase efficiency to survive. Competition from new plywood plants and processing complexes, rising labor costs, and growing environmental concerns demand continued improvements.

Linear programming is an analytical technique helpful in meeting this challenge.

That is the contention of Southern Forest Experiment Station researchers George F. Dutrow and James E. Granskog. Their new publication, "A Sawmill Manager Adapts To Change With Linear Programming," observes one independent operator preparing for the future.

The operator had observed conditions and practices at mills with improved equipment. Although he could eliminate some alternatives as inappropriate, he felt the need for formal analysis of those that appeared promising.

He implemented improvements suggested by the analysis, and found that linear programming helped him expand his mill, evaluate potential revenues, and formulate strategies. Results showed a 45 percent increase in revenue and a 36 percent hike in volume processed.

Although this analysis applies only to one sawmill, linear programming does have general applicability. "An important addition to the manager's survival kit," the authors call the technique.

Copies of Forest Service Research Paper SO-88 are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113.

Construction To Begin On Auburn Laboratory

Construction will begin soon on a laboratory building to house the USDA Forest Service Southern Forest Experiment Station's engineering and silvicultural research in Auburn, Alabama. Bids were opened on April 18. The building contract has been awarded to Lynn H. Blair Contractors, Inc., Alexander City, Alabama, in the amount of $684,699, according to Southern Station Director John C. Barber.

Plans call for approximately 25,000 square feet of office and laboratory space on a 6-acre site on Auburn University campus. Phase I of the construction will include completing the outer shell of the building, the interior portion to house the engineering research unit, necessary access roads, and site development work.

Phase II, to be scheduled when appropriations become available, will include completion of the interior portion of the building to house a silvicultural research unit, a headhouse-greenhouse complex, work shop, and a chemical storage building.

The engineering research unit to be housed in the new laboratory has been occupying space loaned to the USDA Forest Service by Auburn University. This unit is the only federal forest engineering research group in the South.

Applying super-phosphate before planting.

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plemental feeding has been tried. Often, though, a combination of nutrients is needed rather than a single element. Loblolly pine may require a slightly higher level of nutrients than slash pine.

In their response to mineral nutrients, trees are influenced by their physiological condition and genetic make up, and also by various environmental conditions. Fertilization at planting time may be ineffective unless competition from grasses and other vegetation is controlled. Shoulders said researchers find the complex responses difficult to anticipate. Spectacular gains from fertilization may depend as much on developing strains of southern pines that are unusually responsive as on solving other problems in pine nutrition.

In a new publication, Shoulders and his coworker William H. McKee, Jr., consider both soil and plant aspects of the problem. They summarize knowledge of chemical properties that determine the ability of soils to hold nutrients added for pines, and they evaluate results of a number of greenhouse and field studies. They also outline areas where additional information is needed. Their discussion is concerned chiefly with pine growth on the Coastal Plain soils of Arkansas, Louisiana, Mississippi, and Texas. Much of it, however, applies equally well to other parts of the South.

Copies of "Pine Nutrition in the West Gulf Coastal Plain: A Status Report," are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113. Ask for Forest Service General Technical Report SO-2.

Sand Pines Promising For Sandy Sites

The 6 million acres of sandhills in Florida, Georgia, and the Carolinas are inhospitable to most trees. The soils dry quickly after rains, and most are covered with wiregrass and scrub oaks. Research scientists have found, however, that the Choctawhatchee variety of sand pine can produce impressive amounts of usable wood fiber under these unfavorable conditions. Although the species is native only to Florida, it is growing well in 10-year-old test plantings in Georgia and South Carolina.

Because of the pressing need to increase wood production in the South, a book devoted entirely to sand pine has been issued by the Southeastern Forest Experiment Station. Based upon papers presented at a recent Symposium of researchers and practicing foresters, the book covers subjects ranging from nursery practices to the management and harvesting of plantations and the conversion of the tree into various products. Results of research on site preparation, planting methods, and projected yields will interest landowners in sandhill areas. An acre of 400 sand pines in an unthinned plantation can be expected to yield as much as 35 cords of merchantable pulpwood at age 35. In addition to the pulp and paper industry, future markets for sand pine include the manufacturers of lumber, plywood, and particleboard.

Copies of the *Sand Pine Symposium Proceedings* can be obtained from the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, North Carolina 28802. Ask for General Technical Report SE-2.

An unthinned, 35-year-old plantation of Choctawhatchee sand pine in the west Florida sandhills.

Land-Use Planners Get Handy Helper

The U. S. Department of Agriculture has issued a reference booklet summarizing 80 programs of assistance to land-use planners.

The booklet provides general descriptions of the programs, some of which are applicable in urban as well as rural development. With it as a guide, local, county, and State planners can contact any of the several thousand county offices of various USDA agencies, the 3,000 Soil Conservation Districts, research centers of the State land grant universities or State agricultural departments for details of individual programs.

The business-envelope-size publication is entitled "Land-Use Planning Assistance Available Through the United States Department of Agriculture." It may be secured for 60 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

PROTECT PROFITS BY HEDGING PINE

Southern pine manufacturers and wholesalers can protect profits from fluctuating prices by buying or selling futures—commitments to receive or deliver cars of lumber or plywood.

Although futures contracts call for Western species, Southerners can hedge pine, as Lloyd Irland and James Olmedo, Jr., demonstrate in "Hedging Southern Pine Through Futures Trading." Hedging is simply the practice of taking opposite positions in cash and futures markets. Since cash and futures prices tend to move together, losses on one commitment are roughly balanced by gains on the other.

Irland and Olmedo explain why southern pine, an off-contract species, can be hedged. The cash prices of southern pine products are so closely correlated with the futures prices of the contract grades that hedging is possible. In addition, the basis—the dollar spread between cash and futures prices—moves in a roughly predictable pattern. When basis changes can be foreseen, hedgers can actually earn trading profits.

Hedging increases marketing flexibility. By relying on futures, manufacturers and wholesalers can take orders at firm prices several months ahead. Also, commitments in futures can substitute for physical inventory holdings and can thus mean savings on storage charges.

Other benefits of hedging and its potential costs are explained in Research Paper SO-91. Copies are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113.

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